Saskatchewan
Agriculture

Annual Report
1985-86

Saskatchewan Agriculture

The Saskatchewan Agricultural Research Fund

87-01145/

Saskatchewan Agricultural Research Fund

To His Honour,
The Honourable Frederick W. Johnson
Lieutenant Governor of the Province
of Saskatchewan

Sir:

I have the honour to submit the Sixth Annual Report of the Saskatchewan Agricultural Research Fund for the period April 1, 1985 to March 31, 1986.

I have the honour to be Sir,

Your obedient servant
Grant Devine
Premier and Minister of Agriculture

The Saskatchewan Agricultural Research Fund

Honourable Grant Devine
Premier and Minister of Agriculture

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It is my pleasure to present the Sixth Annual Report of the Saskatchewan Agricultural Research Fund for the period April 1, 1985 to March 31, 1986.

Respectfully submitted

J.L. Drew
Deputy Minister of Agriculture

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Respectfully submitted

S. Ann Barnsley
Chairman of the Saskatchewan
Agricultural Research Fund

Introduction

The Saskatchewan Agricultural Research Fund was established by the June 15, 1979 proclamation of the Agricultural Research Funding Act. The Fund consists of such money as may be appropriated annually by the Legislature, the annual earned interest, plus other money which may be transferred into the Fund by the Lieutenant Governor-in-Council. A portion of the funds are made available annually to individuals, corporations, co-operatives, associations or other organizations for the purpose of agricultural research in the Province. Applications are invited annually from interested parties. Initial appropriation for 1979-80 fiscal year was $3.25 million.

The Fund is administered by a producer-represented Board which has the authority to make grants, loans or guarantees or enter into agreements or contracts respecting assistance provided to persons. The Board as appointed by the Lieutenant Governor-in-Council, consists of seven persons, including five practising agricultural producers and two agricultural research professionals. The Chairman and Vice-Chairman of the Board are designated by the Lieutenant Governor-in-Council. The Deputy Minister of the Saskatchewan Department of Agriculture serves as an advisor to the Board. The Board is responsible to the Minister of Agriculture.

Activities 1985-86

In 1985 the Board met to review 83 applications requesting approximately $1.7 million. Twenty-five proposals were awarded grants totalling $378,250. The four third year projects received a total of $84,000 while $115,250 was awarded to the nine second year projects. Twelve new projects received support totalling $179,000.

Information on thirty-two projects are presented in one section followed by the objectives and potential impact of the seventeen on-going projects. Additional information on all projects, including technical reports, is available from the Board secretary or the individual grantees.

The financial statements of the Fund have been audited by the Provincial Auditor. These statements are presented in the final section of this report.

The Board appreciates the interest shown in the Saskatchewan Agricultural Research Fund and would like to thank all who submitted proposals in 1985.

Saskatchewan Agricultural Research Fund Board 1985-86

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SECRETARY **Ms. Brenda Machin**
Saskatchewan Agriculture
3085 Albert Street
REGINA, S4S 0B1

Distribution of Projects and Funding by Program Area

Program Area	Awarded 1984-85	Awarded 1985-86	% of Total Awarded 1984-85	% of Total Awarded 1985-86	Assigned 1984-85	Assigned 1985-86	% of Total Assigned 1984-85	% of Total Assigned 1985-86
Cereal Crops	3	5	10.7	20.0	40.500	73.000	9.1	19.3
Special Crops	4	3	14.3	12.0	54.500	37.000	12.2	9.8
Forage Crops	2	2	7.1	8.0	45.000	30.000	10.1	7.9
Horticultural Crops	3	2	10.7	8.0	20.900	19.750	4.7	5.2
Ruminants	5	7	17.8	28.0	80.300	122.000	18.0	32.3
Non-Ruminants	4	1	14.3	4.0	99.200	30.000	22.3	7.9
Land, Air, Water	4	3	14.3	12.0	61.000	44.000	13.7	11.6
Energy, Equipment	1	1	3.6	4.0	15.000	8.500	3.4	2.3
Socio-Economics	1	1	3.6	4.0	15.000	14.000	3.4	3.7
Miscellaneous	1	-	3.6	-	14.000	-	3.1	-
Total	28	25			445.400	378.250		

Approved Projects 1985

Title	Research Manager	Institution	Amount
Cereal Crops			
Biology & Control of the Wheat Blossom Midge in Saskatchewan	J.F. Doane	Agriculture Canada Research Station Saskatoon	10,000
The Effect of Growth Regulators on Winter Survival, Lodging and Yield of Norstar Winter Wheat and Muskateer Fall Rye	L.V. Gusta	Crop Development Centre Univ. of Saskatchewan	15,000
Development of Techniques and Strategies of Selection for Grain Yield, Protein Content, and Kernel Hardness in Wheat Using Near-Infrared Spectroscopy	T.N. McCaig	Agriculture Canada Research Station Swift Current	18,000
Evaluation of Sources of Resistance to Speckled Leaf Blotch of Wheat	G.R. Hughes	Dept. of Crop Science and Plant Ecology Univ. of Saskatchewan	14,000
Screening Durum Wheat and Wild Emmer Wheat Germplasm for Drough Tolerance	S. Jana	Dept. of Crop Science and Plant Ecology Univ. of Saskatchewan	16,000
Special Crops			
Development of a Bleaching Resistant Green Cotyledon Dry Pea for Saskatchewan	A.E. Slinkard	Crop Development Centre Univ. of Saskatchewan	14,000
Nutritional Evaluation of Low Mucilage Canola Meal	J.M. Bell	Dept. of Animal and Poultry Science Univ. of Saskatchewan	20,000
A Re-evaluation of Seed Treatments of Pulse Crops	R.A.A. Morrall	Dept. of Biology Univ. of Saskatchewan	3,000
Forage Crops			
Renovation of Pastures by Direct Seeding	J. Waddington	Agriculture Canada Research Station Swift Current	15,000
The Lesser Clover Leaf Weevil *Hypera nigrirostris*: Ecology and Control in Red Clover Seed Crops	C.H. Craig	Agriculture Canada Research Station Saskatoon	15,000
Horticulture			
Rooting of *Amelanchier alnifolia* Shoots Produced *in vitro* and the Subsequent Establishment of Rooted Shoots Under Greenhouse or Field Conditions	C. Stushnoff	Dept. of Horticulture Science Univ. of Saskatchewan	15,000
Vegetable Varietal Trial	C.O. Green	Prairie Produce Ltd. Outlook	4,750
Ruminants			
To Evaluate Practical Post-Partum Nutritional and Drug Management in Controlled Breeding of Beef Cows	D. McCartney	Agriculture Canada Research Station Melfort	4,000
Intensification of Sheep Production Under Prairie Conditions	N.C. Rawlings	Western College of Veterinary Medicine Univ. of Saskatchewan	30,000

Evaluation of Protein Status of Lactating Dairy Cows	D.A. Christensen	Dept. of Animal and Poultry Science Univ. of Saskatchewan	17,000
Development of Subunit Vaccines for Control of Herpesvirus-1 (Infectious Bovine Rhinotracheitis - IBR) Induced Respiratory Disease (Shipping Fever)	S. van den Hurk	Veterinary Infectious Disease Organization Saskatoon	15,000
Improvement of Production Efficiency of Livestock by Vaccination Against Somatostatin	B. Laarveld	Dept. of Animal and Poultry Science Univ. of Saskatchewan	26,000
Testing a Vaccine for Viral Calf Scours	S.D. Acres	Veterinary Infectious Disease Organization Saskatoon	14,000
The Roles of Insulin, Glucose and Free Fatty Acids in the Development of Ketosis and Fatty Liver Disease in Ruminants	R.K. Chaplin	Western College of Veterinary Medicine Univ. of Saskatchewan	16,000
Non-Ruminants			
Swine Barn Ventilation	E.M. Barber	Dept. of Agricultural Engineering Univ. of Saskatchewan	30,000
Land, Air, Water			
The Determination of Trifluralin Levels in Soil by Instrumental Analysis and Bioassay	R.B. McKercher	Dept. of Soil Science Univ. of Saskatchewan	20,000
Mineralogy, Morphology and Dynamics of Salts in Agricultural Soils in Saskatchewan	A.R. Mermut	Dept. of Soil Science Univ. of Saskatchewan	17,000
Agricultural Use of Sludge from Regina Wastewater Treatment Plant	T. Viraraghavan	Faculty of Engineering Univ. of Regina	7,000
Energy, Equipment			
Comparative Efficiency of New Low Volume Applicators for Use With Herbicides	R. Ashford	Dept. of Crop Science Univ. of Saskatchewan	8,500
Socio-Economics			
The Comparative Advantage of Wheat Production in Saskatchewan	W.H. Furtan	Dept. of Agricultural Economics Univ. of Saskatchewan	14,000

Summaries of Completed Projects

Cereal Crops

"Canopy Penetration and Deposition Patterns For Insecticide Spray Intended for Wheat Midge Control"

K. Yoshida and K. Wallace
Saskatchewan Research Council
Saskatoon

$12,000
1 year

At different stages of its life cycle, from egg to larva to moth, the wheat midge resides in different places in a growing crop. The ability to control it, through timely use of insecticides, depends on applying the spray in such a way as to put the most chemical where the midge is present before it begins to damage the crop. It is important therefore to determine the fractions of insecticide deposited from an aerial application onto the wheat heads, the foliage and the ground under different spraying conditions.

Samplers were placed in a wheat field infested with wheat midge in the Tisdale area in mid-July of 1985. A Piper Pawnee applied Lorsban 4E at a rate of 0.45 kg/ha of active ingredient. Hollow cone, D10-45, nozzles were used at application rates of 18 and 35 L/ha. In our experiments a fluorescent dye was added to serve as a tracer, Further, less detailed, trials were carried out using a Spracoupe ground applicator and an Agwagon aircraft fitted with rotary atomisers in place of conventional nozzles; this last test was carried out on an infested wheat field near Canora.

Results showed that nearly half of the spray was deposited on the crop foliage, with 10% of this amount on the wheat heads themselves. The remaining half of the droplets penetrated the crop and became deposited on the ground. There is an indication that if a finer spray were used more insecticide would be collected by the wheat heads, stems and leaves. Analysis of the different parts of the wheat head seems to show that the spray solution does penetrate the outer covering of the head.

Entomologists, and other insect control specialists, can use this information to recommend application equipment and nozzle types to provide improved insecticide efficacy for wheat midge control at different stages of the infestation.

Special Crops

"Canola Press Cake As A High Energy, High Protein Animal Feed"

J.M. Bell and M.O. Keith
Department of Animal and Poultry Science
University of Saskatchewan
Saskatoon

$24,000
1 year

Press cake is the partially extracted material obtained from the hydraulic expeller in a canola crushing plant. The extraction process to this stage inactivates myrosinase which, if active, can hydrolyze glucosinolates which in turn may affect thyroid activity and animal performance. Press cake may be a potentially useful energy and protein source. However, no study has been made of press cake as a feedstuff, consequently this study was undertaken to characterize its nutrient composition, glucosinolate content and digestibility in order to determine its nutritional value for swine.

Samples of canola seed, press cake and meal were obtained from runs in four successive weeks from each of seven crushing plants in Western Canada. Each sample was subjected to analysis to determine protein, ether extract (oil), glucosinolates and myrosinase enzyme activity. One lot of press cake was used to determine digestibility of energy and protein for pigs. Press cake contained 21% oil (range 17.5 to 26.7) and 33% crude protein (27.7 to 36.5). Digestibility coefficients were 75.2% for energy 81.5% for crude protein. The average digestible energy value was estimated to be 4100 kcal/kg but this varied with the amount of oil in the sample. Using the Peterson formula for estimating the monetary value of a feed, and using good barley and canola meal as representative energy and protein feeds, it is tentatively estimated that average press cake may be worth from 1.7 to 2.7 times the price of good barley when used in swine feeds as a competitive source of digestible energy and protein.

"Scentless Chamomile Control Program"

G.G. Bowes, A.G. Thomas and M.G. Maw
Agriculture Canada
Regina

$18,200
2 years

This project identified the major habitats where scentless chamomile grows best and developed several control methods. The Balgonie-Zehner area was chosen for the study because the weed has been growing in this area for 70 years. A survey of four sections of weed infested land near Balgonie, revealed that scentless chamomile was more abundant in sloughs, waste areas and transition areas between two other habitats than in cropland and solid stands of grass. In non-cropland areas, high rates of Tordon 22K (0.6 L/ac), Tordon 101 (2 L/ac) and Ally (20 g/ac) adequately controlled the vegetative growth of scentless chamomile. In the treated areas, scentless chamomile did not set seed during the year of herbicide application or during the following year. Grass yields increased the year following herbicide treatment. Solid stands of grass should compete against emerging scentless chamomile seedlings. Brome was successfully seeded and established in a non-cropland area but it will be several years before it is known if scentless chamomile re-establishment can be prevented. Since scentless chamomile was not very abundant in grass habitats, farmers are encouraged to maintain solid stands of perennial grasses in non-cropland areas.

The application of Ally (4 g/ac), Glean (12 g/ac) and Torch (0.3 kg/ac) at rates which spring wheat (HY320) can tolerate, adequately controlled and prevented seed set on scentless chamomile plants which germinated in the spring. Scentless chamomile was not very competitive in a good stand of HY320 wheat.

For a long-term control program to be effective, seed set must be prevented. Solid stands of scentless chamomile can produce 1.2 million seed/m2 and while these seeds do not show any dormancy, they will not

germinate immediately if they are buried and are not exposed to light. Because of scentless chamomile's ability to reproduce rapidly and it's seeds to remain viable in the soil until exposed to light, farmers should never transport scentless chamomile plants or seeds from infested non-cropland areas to cropland areas.

None of the insects collected from scentless chamomile caused sufficient damage to the weed to be considered suitable for a biological control program. Also, scentless chamomile did not harbour any insect pest.

Users should read product label for the most recent use registration. Non-registered herbicides should not be used.

Forage Crops

"Fertilizer Requirements of Grazed Seeded Grass Pastures and the Effects on Nutrition and Production of Beef Cattle"

R.D.H Cohen
Department of Animal and Poultry Science
University of Saskatchewan $85,000
Saskatoon 3 years

Four levels of nitrogen fertilizer (0,50,100 and 200 kg N/ha) were applied to two 2 ha replications of a 32 year old bromegrass/crested wheatgrass pasture in each of three years. Measurements were made on pasture production, quality and utilization by grazing heifers and also on animal production and number of grazing days.

Pasture day matter production was increased by approximately 40 percent by fertilizer application and maximized at 100 kg N/ha in a wet year, 1983, and at 200 kg N/ha in a dry year, 1984. The number of animal grazing days and total liveweight production increased by up to 76% and 113% respectively at 200 kg N/ha in all years. The application of fertilizer greatly condensed the pasture growing season but this effect was greatest in a wet year compared with a dry year.

Pasture crude protein, copper and iron contents increased with increasing fertilizer application but fertilizer did not influence any other quality factors. Pasture protein digestibility, phosphorus and potassium declined with pasture maturity while calcium, zinc and iron increased with maturity. Evidence of nutrient deficiencies for pregnant heifers was apparant for crude protein and copper on all unfertilized pasture but not on fertilized pasture. Phosphorus was deficient on all pastures, particularly as they matured and more so in a dry year. High levels of iron in the pasture may interfere with the metabolism and absorption of other minerals such as phosphorus, copper, zinc, manganese, cobalt and selenium. There was also evidence that high levels of nitrogen fertilization may increase the risk of grass tentany, particularly during the first 28 days of grazing.

There was some accumulation of nitrogen in the soil at 0.15 and 15-30 cm with increasing fertilizer application but nitrogen fertilizer did not influence soil phosphorus, potassium or sulfur. Soil phosphorus levels were inadequate for maximum pasture production but potassium and sulfur levels were always adequate.

The results of this experiment suggest that current pasture fertilizer recommendations of 35-100 kg N/ha are inadequate for maximum beef production on this soil type.

Horticulture Crops

"Inhibitory Effects of Green Foxtail (Setaria viridis L.) on Onion Plants"

D.H. Dabbs and P.L. Englund
Department of Horticulture Science
University of Saskatchewan $24,000
Saskatoon 2 years

Studies were conducted to test the hypothesis that green foxtail produces a phytotoxin that inhibits onion growth. Experiments were conducted to separate competitive from allelopathic effects of green foxtail on onions.

Field trials revealed that severe onion yield reductions occurred at green foxtail densities common to cultivated fields on the prairies. All green foxtail densities tested significantly reduced onion yields. All four onion cultivars tested responded similarly in their response to green foxtail interference. It was concluded that green foxtail does cause a drastic reduction in the growth of onions. This reduction was probably due to competitive effects and partly to allelopathic effects of green foxtail on onions.

Growth chamber experiments attempted to separate the competitive effects of green foxtail from the allelopathic effects. Results indicated the presence of an unidentified phytotoxin.

The "Competition" experiment demonstrated that when onion and green foxtail were grown together, with no competition occurring, onion growth was still inhibited. Significant differences occurred between onions grown in contact with green foxtail and those not in contact. However, no significant differences occurred between green foxtail in these two treatments. If competition had occurred there should have been differences in green foxtail growth also.

Onion plants watered with leachate collected from pots of green foxtail were about 27% shorter and weighed approximately 49% less on average than those watered with Hoagland's solution. Leachates were analyzed for nutrient content and found to contail at least as many nutrients as non-leached Hoagland's solution.

Significant differences also occurred when radicle growth of germinated onions was measured after being grown in extracts from green foxtail shoots and roots for 48 hours. Shoot extracts severely reduced radicle growth compared to root extracts and a control of distilled water. It appears that something is released from green foxtail shoots during soxhlet extractions that inhibits onion growth.

It was concluded that an allelochemical is released by green foxtail plants that interferes with onion growth.

The nature of this chemical and its release mechanism from the green foxtail plant are unknown. This study stresses the importance of ridding onion fields of this weed: possibly by registering a pre-emergent herbicide to prevent grassy weed growth in onions. A more complete understanding of these deleterious effects will be needed in this search.

"Using Etiolation as a Pre-Treatment in the Propagation of Softwood Cuttings"
S.H. Nelson
Department of Horticulture Science
University of Saskatchewan $8,400
Saskatoon 2 years

There has been considerable interest in prairie Canada for the promotion of the native saskatoon berry (Amelanchier alnifolia Nutt.) as a commercial crop. In Alberta a government-assisted program has established plantings and has demonstrated a very good market for the fruit as pick-your-own, frozen and preserved products, and particularly as syrup.

The lack of advancement in the industry has concerned researchers and nurserymen and in 1980 a symposium was held in Edmonton, Alberta. It was concluded that the limiting factor at that time was the inability to propagate the large-fruited, more desireable types in sufficient quantity economically. For the immediate future the industry would have to depend on the less desireable seedling forms - a situation that still exists.

Cuttings and grafting are the normal methods of propagation used by the nurserymen with grafting being the more expensive method. Saskatoons do root, but the rather poor root system produced does not transplant well. Treatment with auxins as aids-to-rooting does not bring on increased root masses in the concentration range of powdered preparations normally available.

The purpose of this study was to test etiolation of the parent stock plant before the cuttings were taken and tc also test the use of a stronger concentration of auxin in a quick dip solution. Etiolation, ie. the exclusion of light to produce cholorotic growth, has long been known as an aid-to rooting, but not used in more recent years because of improved propagating systems.

Recently, it has been demonstrated in England and Ireland that the early forcing of stock plants under black polyethylene greatly enhances rooting on a number of difficult-to-root plants.

Black polyethylene tents were placed over dormant saskatoon bushes that had been rejuvenated by relatively severe pruning to create vigorous growth. After the buds had produced shoots and had produced sufficient growth to make the cutting, the tissue was allowed to regreen for six days before the cuttings were made. This procedure was necessary because the etiolated tissue did not survive the direct sunlight when put in the intermittent mist beds outdoors. Taping the bases of the etiolated shoots to continue the etiolating process to that portion of the shoot was not warranted. The regreened shoots rooted in greater percentage and produced greater root mass than those shoots produced in direct sunlight. There was also a positive, but lesser, effect from using the stronger concentration of auxin. Intermittent mist propagation beds enclosed in a clear polyethylene tent were superior to those equipped with bottom heat, but an open top. The increased root masses produced should assist in the transplanting success of this native fruit.

Ruminants

"Study of a Bleeding Disorder in Simmental Cattle"
G.P. Searcy
Department of Pathology
Western College of Veterinary Medicine
University of Saskatchewan $15,800
Saskatoon 1 year

A bleeding disorder in Simmental cattle has been recognized in Western Canada since 1972. Similar animals have been reported in Kansas and Ohio. Owners report excessive hemorrhage following minor surgery in calves followed by chronic hemorrhage as adult animals. Persistant nasal hemorrhage in cold weather has been described in addition to hemorrhage in the urinary tract or following major surgery. The prolonged hemorrhage results in depletion of iron stores and debility.

Laboratory evaluation of these animals has revealed a platelet function disorder. Platelets are tiny cells in the blood important in the early events which follow vascular injury. They quickly adhere to the inner surface of the damaged vessel and then release substances which attract more platelets to bind to the adherent platelets and form a platelet plug. Studies at the Western College of Veterinary Medicine have revealed that platelets in suspension are stimulated with various agonists known to result in aggregation. These studies have been conducted in an instrument known as a whole blood aggregometer in which platelets in suspension are stimulated with various agonists known to result in aggregation. The rate of aggregaton can be measured. Studies of bleeding Simmental cattle and normal cattle revealed a marked difference in aggregation with affected platelets showing little or no aggregation in response to agonists which bring about rapid aggregation of platelets from normal cattle.

Platelet aggregation occurs because of binding of large fibrinogen molecules to membranes of adjacent platelets in a bridging-like phenomenon. In order for fibrinogen to bind to platelets, there must be a receptor molecule for fibrinogen on the platelet surface. Studies in man have revealed the presence of such a receptor which is deficient in children with a disorder known as Glantzman's Thrombosthenia.

Studies at the Western College of Veterinary Medicine have been carried out in order to assess the presence or absence of the fibrinogen binding receptor molecule on the platelet membrane. The initial results revealed no differences in this molecular complex in affected and normal bovine platelets. However the similarity of this disorder to Glantzman's Thrombosthenic children necessitates that further more sophisticated techniques must be employed to study the platelet membrane molecules responsible for fibrinogen binding.

"Electronic Identification of Livestock"

G.C. Zoerb and J.W. McLean
Department of Agricultural Engineering
University of Saskatchewan
Saskatoon

$13,500
1 year

Animal identification is the key to unlocking the use of electronics and computers in the livestock industry. Electronics can be tailored to many configurations to make a useful electronic identification (EID) system. Other researchers have developed many different techniques to solve the problem of EID of livestock. This project is investigating EID in an attempt to advance it for the benefit of the Saskatchewan livestock industry. The objective is to bring EID closer to reality for the industry. Investigation and development of an EID system would provide: proof of ownership for the producer, the ability to control disease by being able to trace it, better record keeping of performance from birth to slaughter for herd management purposes, increased security against stealing and the possibility of phasing out the brand. The above benefits would have an economic ripple effect through the Saskatchewan livestock industry.

In the development of electronic identification for livestock, our research has shown that the next step must be the improvement of the interrogation range and to answer the question of whether to use a passive, unpowered, or active, battery powered, EID tag. Through an investigation of commercial systems, ideas about how to improve the interrogation range and EID systems in general were formulated. Field tests were performed using System ID 3000 EID equipment at the Himmelsbach Farm, in Goodsoil, and at the University of Saskatchewan feedlot. For the purposes of this study the investigation of ideas to increase the interrogation range are pertinent to implantable devices. This study had concluded that an active system should be used. With this information and knowledge of previous work in EID, the emphasis of the remainder of this project centered on the analysis of alternative interrogation methods. The analysis involved the investigation of the regions of the electromagnetic spectrum to evaluate them as methods of interrogation. The research disclosed that radio frequency (RF) interrogation or a combined infrared (IR) and radio frequency system of interrogation provide the greatest potential for electronic identification of livestock. Laboratory studies are being completed to determine the most suitable system for electronic identification in the livestock industry.

Non-Ruminants

"Evaluation of the Bioavailable Biotin from Saskatchewan Feed Ingredients for Pigs"

R. Misir, R. Blair
Department of Animal and Poultry Science
University of Saskatchewan
Saskatoon

$8,000
1 year

Biotin is a water-soluble vitamin which functions as cofactors of enzymes involved in carbohydrate metabolism and fatty acid synthesis. Under modern intensive production systems, poultry and swine otain their biotin supply mainly from the dietary ingredients. Canola meal (CM) which is a major protein supplement in diets for poultry and swine also contains high levels of biotin (1100-1300 ug/kg). There is a lack of information on biotin availability from CM and cereal plus CM when these are included in diets for monogastric species. The objective of this study was to compare the availability of biotin from CM, soybean meal, cereal grains and cereal grain plus CM in diets for broiler chicks, turkey poults and young pigs in order to determine whether practical CM diets would require supplementation with synthetic biotin to meet the animal's requirements. An additional study was conducted with rats to establish whether the biotin availability data obtained would be applicable to diet formulation for poultry and swine.

The biological availability of biotin from canola meal (CM), CM supplemented cereal diets and also soybean meal and cereal grains in diets for starting broiler chicks and poults, and young pigs was estimated by means of a standard-curve procedure. For all the animal species, biotin availability estimates followed essentially the same pattern for each of the ingredients or cereal-CM combinations tested in the diets. Biotin availability values (%) were high for canola meal (65-71) and generally low in cereal grains, e.g., 19-24 for barley. The actual quantity of available biotin (ug/kg) was highest for CM (805-873), moderate for soybean meal (220-280), and low for cereal grains, i.e., ranging from 23 for wheat (chicks and poults) to 90 for corn (chicks). These results indicated that canola meal might be a major source of available biotin in practical diets for chicks, poults and young pigs. A combination of canola meal plus cereal grain in the diets would increase the supply of vailable biotin for these species. Biotin availability data from rats might not be applicable to diet formulation for poultry and swine.

"Quantification of the Increase in Feed Consumption Due to Social Facilitation"

N.J. Lewis
Department of Animal and Poultry Science
University of Saskatchewan
Saskatoon

$15,000
1 year

Pigs which see other pigs feeding begin to eat also. This very common behaviour in social mammals is called "social facilitation". The purpose of this study was to determine if this behaviour could be used to encourage feed consumption in early weaned pigs. Two basic questions were asked in setting up the experiment. Firstly, if we could stimulate hunger by exposing pigs to other feeding pigs, would the pigs compensate by eating less at another time? Secondly, how many feeding pigs would we need to encourage resting pigs to get up and eat? Within the context of the second question we also asked, is it necessary for the pigs which we want to encourage to eat, to see the other pigs feeding or would hearing the other pigs feeding be equally effective? The operant conditioning apparatus used to study the feeding behaviour in this experiment was capable of determining when each gram of feed was consumed, providing a very accurate estimate of feed consumption minute by minute throughout the day and night. At the same time it provided a measure of the importance of the feeding behaviour to the pig. Their degree of motivation could be determined by the amount of work

the pig was willing to do to get feed. In this case each pig was trained to push a panel 1 or 4 times in order to get 1 gram of feed.

Twenty eight experimental pigs weaned at 28 ± 3 d were exposed individually to seven treatments to stimulate feeding: four hungry pigs; four full pigs; two hungry and two full pigs; two hungry pigs; one hungry pig; the recorded sounds of pigs feeding and an empty pen (control). The amount of feed consumed by each experimental pig and the time at which each gram of feed was consumed were recorded using the operant conditioning apparatus. The results indicate that fully satiated weaned pigs are attracted to feed if they observe other pigs feeding. At least four feeding pigs are necessary to provide a good stimulus for social facilitation. Although immediate feed consumption was increased, overall feed consumtion was not increased by any of the treatments. However, the pigs in this study were already consuming feed at adequate levels. Young pigs which were not feeding well would be more likely to increase their overall consumption due to social facilitation. The sounds of other pigs feeding were not adequate to produce social facilitation.

Encouraging feeding using social facilitation appears to be an easy and inexpensive way to help pigs over the period of initial low feed consumption. To obtain the maximum benefit from this behaviour, newly weaned pigs should be placed next to pens with older pigs which are feeding well. These older pigs would be encourage to feed in groups of 4 or more by providing fresh feed at frequent intervals. If solid walls are present between pens the effect to pigs feeding in the next pen will be negligible.

"Oxate Content in Feeds and Its Metabolism by Ponies"

N.F. Cymbaluk
Department of Animal and Poultry Science
University of Saskatchewan
Saskatoon

$7,700
1 year

Agriculturally, oxalic acid in plants, a dicarboxylic acid produced during normal plant growth, is important as a toxic antagonist to divalent cations especially calcium. Total oxalate in plants represents a soluble portion as a potassium or sodium salt and an insoluble portion bound to calcium. Soluble oxalate may be absorbed and at high intakes is believed to cause acute hypocalcemia and death in ruminants by binding with calcium in plant tissues making it inavailable for absorption. In alfalfa hay as much as 20-33% of calcium has been reported to be inavailable for digestion by cattle. Thus, insoluble oxalate can depress calcium availability and cause secondary calcium deficiency. A chronic calcium deficiency would be expected to cause bone abnormalities. Oxalic acid content in prairie feeds has not previously been considered high enough to be an important calcium antagonist.

Two hundred (200) feed samples were analyzed for total oxalate by a gas chromatographic method. Total calcium concentration was also measured. The results of the survey are given in Table 1. Legumes, mainly alfalfa hays, contained the highest calcium and oxalate concentrations (P 0.05) of all feedstuffs evaluated with the exception of one kochia hay which contained 3.2% oxalate, a level which would cause acute toxicity in cattle. Approximately one-half of the grass hay samples contained no oxalate. In grass samples positive for oxalate, the molar ratio of oxalate: calcium was 0.37. The molar ratio of oxalate to calcium was highest in native and domesticated grass and cereal hays. The oxalate:calcium ratio indicated that 36 to 44% of calcium could be potentially bound by oxalate in grass and cereal hays and about 25% of calcium could be bound in legume or legume-grass hays.

Available calcium was calculated by subtracting total molar oxalate concentration from total molar calcium content. The available calcium was determined to be greater than 1% in 80% of legume hays. Yet, the available calcium was below 0.2% in 33 to 62% of grass, native and cereal hays in the study. Calcium concentrations less than 0.2% would not supply adequate calcium for maintenance of mature cattle or horses. Thus, oxalate antagonism is more important in forages normally low in calcium such as grass or cereal hays. These forages should be fed to livestock with inorganic calcium supplements.

Oxalate and calcium concentrations were measured in serially obtained samples from plot-grown grass and legume forages. None of the grass samples contained oxalate; alfalfa and sweet-clover contained 0.75 to 0.8% oxalate. The oxalate concentrations did not change in these forages throughout the growing season.

Digestions studies were conducted using ponies fed various forages. Calcium and oxalate balances were determined. Negative or low calcium balances were obtained when cereal hays were fed despite adequate calcium intakes. The negative calcium balance was attributed to an increase in calcium excretion in urine. Oxalate digestibilities were significantly higher from oat and barley hays than from alfalfa, brome or slough hays ($P < 0.05$) This suggests that cereal hays contain more soluble oxalate than other forages and this might increase urinary calcium loss. These observations confirm the need for provision of adequate mineral supplementation when feeding cereal hays.

The oxalate in prairie feeds is at a concentration that would be expected to cause secondary calcium deficiency. Oxalate concentrations that would cause acute toxicity in cattle were present in one kochia hay. Addition of inorganic calcium supplements to forage diets would compensate for calcium bound to oxalate.

Table 1. Average calcium and oxalate concentrations (% dry matter) and oxalate:calcium ratios in feedstuffs

Feedstuff	No.	Calcium	Oxalate	Oxalate:calcium Ratio
Legume	68	1.55	0.80	0.26
Legume-grass	30	1.15	0.63	0.25
Grass	58	0.55	0.14	0.22
Native grass	9	0.44	0.31	0.36
Cereal hay	24	0.37	0.33	0.44
Grain	4	0.09	0	0
Grain mixes	7	0.41	0	0
Kochia	1	0.80	3.20	1.77

Land, Air and Water

"Irrigation With Groundwater"

J.A. Gillies, B.A. Middleton, D.I. Norum
Department of Agricultural Engineering
University of Saskatchewan
Saskatoon

$35,500
3 years

During the past ten years there has been an increased interest in the use of groundwater for irrigation purposes in Saskatchewan. Many factors have contributed to this increased interest, however the number of projects using groundwater for irrigation has been limited due to the fact that good quality groundwater in quantities necessary to meet irrigation demands is not available. Furthermore, data describing the impact on the irrigated soils, on the quality of groundwater in contiguous surface aquifers, and on the source aquifer are not available. The research results from this project will provide some benchmark information which may be used to evaluate the potential for success of a proposed groundwater irrigation project.

Two farmers, who use groundwater for irrigation, have participated in this study by allowing long-term monitoring of their projects. The sites are south-west of Donovan, pumping from the Tyner Valley Aquifer and south-east of Watrous, pumping from the Hatfield Valley Aquifer.

Guidelines for the quality of irrigation water (Ayers and Westcot, 1976) indicate that using water with an electrical conductivity (EC) value in excess of 3 mS/cm will affect crop water availability. The EC of the irrigation water at both test sites exceeds 3 mS/cm. The salt content of the irrigation water is such that unless adequate quantities of water are applied to induce leaching, the accumulation of soluble salts within the surface layer will continue and may eventually reach levels where crops will suffer. The irrigators should modify their present irrigation practices to provide additional water for leaching, although it is doubtful that either system has the capacity to fulfill such a requirement during periods of peak consumptive use.

After five irrigation seasons at the Donavon site and six at the Watrous site, changes in the quality of the water in the surface aquifer cannot be traced to leaching from the irrigated sites. However, if the practice of irrigation is modified so that additional irrigation water is applied to induce leaching, deterioration of the quality of the water in the surface aquifer is a distinct possibility. Should this occur, particularly at the Donavon site, several domestic water supplies would be affected.

Groundwater pumping rates required to satisfy the irrigation demand have not affected the physical properties of the aquifers. The decrease in piezometric head at the Donavon site appears to be related to the groundwater withdrawal for irrigation. Model studies for this site predict that after four years under conditions of maximum irrigation withdrawal and limited natural recharge, the piezometric head will be lowered about eight meters. Since the observed decrease in peizometric head after five years of pumping has not approached the predicted value, the present scale of development of irrigation with groundwater at Donavon should not impose significant long-term deleterious effects on the aquifer. A similar model study has not been completed for the Watrous Site.

Both irrigators are pleased with their investments. There has not been any visible evidence of increased salinity affecting crops yields. In fact, instances where yields have been less than expected, the irrigators state that their inability to properly manage their systems due to mechanical failures has been the prime contributing factor.

"Use of Leonardite for Soil Improvement"

Z. Abouguendia
Saskatchewan Research Council
Saskatoon

$25,000
2 years

Leonardite is found in large amounts in the coalfields of the Estevan region of southeastern Saskatchewan. The lignite-like material is of low fuel value, but its use as a soil additive has received considerable attention in recent years. Several studies have shown an increase in plant growth and/or improvement in soil properties, including reduction in soil salinity. Most of these studies, however, were carried out under laboratory, growth room or greenhouse conditions and the effects of leonardite under field contions remained virtually unexplored.

The present study was designed to investigate the effects of several rates (ranging from 0.75 to 3.00 kg/m) of soil-appled leonardite at three sites located near Saskatoon, Saskatchewan.

Soil parameters considered in this study included pH, electrical conductivity, water soluble ions, extractable cations, and available nitrogen, phosphorous, and potassium. The analysis of the data showed no statistically significant change in any of these parameters, with the exception of a decrease in potassium at one site during the first year only.

Plant parameters measured included plant density and/or yield. Again no statistially significant change in plant density or yield were noted. The nutritive value of the plants was not affected at any of the treatment rates employed.

It was concluded that under field conditions in the Saskatoon region, the Estevan leonardite has no growth stimulating effects or soil conditioning effects, despite beneficial effects reported in the literature. The contrasting effects may be explained in terms of differences in soil characteristics, in amendment properties and rates, and in experimental conditions.

Miscellaneous

"Extremely High Temperature Saccharification and Fermentation of Agricultural Residues"

D.E. Caldwell
Department of Applied Microbiology and Food Science
University of Saskatchewan
Saskatoon

$25,000
2 years

The objective of research was to determine the value of extreme thermophiles in the fermentation and saccharification of cellulose. Lactic acid was the primary product of fermentation and the strains obtained may be useful in accelerating processes for silage and/or yogurt production. The potential advantages of applying extremely thermophilic organisms include the reduction of cellulase activation energy at higher temperatures, reduced microbial contamination, thermal self-sufficiency, continuous distillation of volatile fermentation end products, and elimination of pretreatment steps.

A total of 73 thermophiles were isolated from steam-heated, cellulose-amended soil enrichments. These strains were preserved by freezing at -20 C in 50% (w/w) glycerol and cultivated using a minimal salts medium containing carboxymethyl cellulose and a small amount of yeast extract which provided unknown substances necessary for growth. The key growth substance was identified as glutamic acid. Vitamins and other nutrients had no stimulatory effect. Of the 78 strains isolated 28 were selected for study. The effect of temperature was determined for each of the isolates. Among these isolates the maximum growth temperature was 75° C, the minimum was 35° C and the optimum was generally 65°. Several strains grew at a specific growth rate of 3.0 per hour which is equivalent to a cell doubling time of approximately 15 minutes. This is more rapid than the growth rate of most other comparable mesophilic and thermophilic organisms. The following fermentation end products were assayed: ethanol, acetone, acetate, buanol, butyrate, crotonate, and lactate. The sole fermentation end product detected was lactic acid. No carbon dioxide was produced, thus indicating homofermentation. Approximately 1 g per liter lactic acid was obtained.

George G. Khachatourians and Tom L. Haffie
Department of Applied Microbiology and Food Science
University of Saskatchewan
Saskatoon

$20,500
3 years

Zymomonas mobilis is a potentially useful organism for commercial biological ethanol production. This bacterium performs consistently well in fermentation trials up to and including pilot plant scale, inspite of its limited substrate fermentation range. To broaden this range, strain improvement schemes, such as genetic exchange, recombination and selection are required.

We have studied the possibility of expanding the fermentation substrate range of this organism to include whey lactose. Transfer of lactase genes have been hampered by the inhibition of *E. coli* donor cells by *Z. mobilis* recipients. The compounds(s) responsible for this effect has been termed *Zymomonas* inhibition factor. Through mutagenesis *Zymomonas* inhibitory negative (Zin-) strains were isolated. These strains represent a major development strain improvement through applied genetic research. We have completed the biochemical analysis of the *Zin-* mutants. *Zin* character was found to be increased by aerobic preincubation and closely correlated to decreasing pH. *Zin-* mutant strains did not acidify the medium and exogenously supplied acid did not restore their inhibitory phenotype. The plasmid DNA content of non-inhibitory strains was indistinguishable from that of the wild-type parent. The primary fermentation end products, that is acetate, acetaldehyde and ethanol were not affected in *Zin-* mutants. We have therefore concluded our search for an improved strain of *Z. mobilis* suitable for substrate range expansion.

Objectives of Current Projects

Cereal Crops

"Biology & Control of the Wheat Blossom Midge in Saskatchewan"
J.F. Doane
Agriculture Canada $13,500
Saskatoon

In 1983 orange wheat blossom midge was discovered in NE Saskatchewan. The subsequent spread of wheat midge and resultant damage to wheat crops in the province (30 million dollars in 1983) emphasize the need for a midge control program. Although insecticides will be necessary for control during severe infestations, ultimately, natural predators may be the most useful agents for long-term control of low levels of wheat midge. Carabid beetles are known to be important biocontrol agents of wheat midge in Europe and of many other insect pest species throughout the world. Therefore, it is logical to suggest that carabids may perform a similar role as predators of wheat midge in Saskatchewan.

The objectives of this study are: 1) to determine the species complex of potential carabid (ground beetles) predators of wheat midge, identify and quantify the most important species and map their seasonal distribution in relation to wheat midge activity; 2) to determine the effect of insecticides on the dominant species of carabids so that, if practical, those insecticides giving the best midge control, but having the least impact on predators, may be selected; 3) to determine by serological tests which species feed on wheat midge larvae in the field. The goal of this project is to provide information aiding in the development of a wheat midge control program utilizing both insecticides and natural control agents in an integrated control approach. Such an approach could result in substantial savings for Saskatchewan farmers if preservation of natural control agents could be augmented by judicious use of insecticides.

"The Effect of Growth Regulators on Winter Survival, Lodging and Yield of Norstar Winter Wheat and Muskateer Fall Rye"
L.V. Gusta
Crop Development Centre
University of Saskatchewan $15,000
Saskatoon

The objectives of this study are to determine if growth regulators affect the lodging resistance, yield and winter survival of winter wheat and fall rye. Both winter wheat and fall rye respond more profitably to high levels of nitrogen than do spring crops. However, high rates of nitrogen in the northern part of the province result in excessive growth which promotes lodging. Lodging can result in decreased yields, sprouting in the head, increased diseases and harvesting costs being three times normal. The growth regulators cycocel, cerone, and terpal have been used in Europe for many years to reduce plant height, reduce lodging and increase yields. Norstar, the main variety of winter wheat grown in western Canada, grows to heights in excess of four feet under high moisture and nitrogen conditions. This has resulted in delayed harvest, sprouting in the head, increased production costs and lodging. Results obtained from this study indicate that certain growth regulators reduce lodging by decreasing plant height. Cycocel applied at growth stage 3 to 4, according to the Feeks scale, increased the yield of Norstar.

"Development of a Bleaching Resistant, Green Cotyledon Dry Pea for Saskatchewan"
A.E. Slinkard
Crop Development Centre
University of Saskatchewan $11,700
Saskatoon

The objective is to develop a bleaching resistant, green cotyledon dry pea for Saskatchewan. Previous studies indicate that bleaching resistance in green cotyledon dry peas is controlled by three mechanisms: 1) reduced rate of imbibition through the seed coat, 2) presence of chlorophyl in the seed coat which filters out some of the sunlight, and 3) resistance in the cotyledons *per se*. Crosses were made between the bleaching resistant line Campbell Scotch Green and Trapper, plus several other powdery mildew resistant lines. Subsequent selection resulted in the isolation of over 80 promising lines. These were evaluated in 1984 and the number reduced to 43 lines which were evaluated in 1985. Data were collected on seed yield (1984, 1985 and the 2-year average), days to first flower (a measure of relative maturity), plant height and 1000-seed weight. However, due to drought stress in both 1984 and 1985, the genotype by environment interaction was unreasonably high (The high yielding lines in 1984 were not the high yielding lines in 1985). Accordingly, most of these 43 lines will be retested again in 1986. The highest yielding line will be entered into the 1986 Field Pea Cooperative Test to evaluate its performance over western Canada.

"A Re-evaluation of Seed Treatments for Pulse Crops"
R.A.A. Morrall
Department of Biology
University of Saskatchewan $9,400
Saskatoon

Two major objectives of this work are: (a) to resolve conflicting data on benefits of treating lentil seed relative to emergence, transmission of ascochyta blight from seed to seedling and effect of transmission on subsequent yield losses, (b) to reassess whether for field pea grown under western conditions there is any value in using seed treatments currently registered in Canada or other new compounds. For these purposes identical trials were conducted in 1985 at Saskatoon, Laird and Elrose to obtain a variety of environmental conditions. Combinations of thiabendazole with carbendazim, imazalil, thiram or vitavax were tested on Eston lentil. Captan, thiram, fenaminosulf, metalaxyl and metalaxyl plus captan were tested on Trapper pea with either 0% or 6% ascochyta infection. Few significant effects were observed on lentil, but there was evidence that thiabendazole reduced seedling transmission of ascochyta. On pea the treatments did not affect emergence consistently among locations and almost no seed to seedling transmission of ascochyta blight occurred. These studies may save pulse growers money in two ways: (a) by demonstrating that current

seed treatments (especially on peas) are unnecessary, or are required only under special conditions, (b) by finding a fungicide that can inhibit seed to seedling transmission of ascochyta in lentil and thereby restrict later disease spread.

Forage Crops

"Renovation of Pastures by Direct Seeding"
J. Waddington
Agriculture Canada $15,000
Swift Current

Several million hectares of permanent pasture and rangeland support the beef industry in Saskatchewan. Much of this land needs a greater legume component to increase forage yield and quality by fixing nitrogen from the air. Productivity on some land would also be better if the grass was replaced with cultivated grasses. Project 3-84-47 is designed to compare four methods of seeding forage legumes into established pasture without cultivation. The four methods are: a zero-till hoe, a triple disk, a single offset disk, and a narrow slot rototiller. Four sites, two in the light brown soil zone (Swift Current and Webb), one in the dark brown zone (Lanigan), and one in a gray-wooded soil (Pathlow) are being used. Roundup was used to kill the vegetation in the south by spraying 1 m wide strips of pasture in June and in the north by spraying 0.3 m wide strips in September. In late October 1985, alfalfa and cicer milkvetch were seeded in the dead strips with the four types of seeders. The triple disk drill and the slot rototiller worked best, in part because each run had its own depth control. The offset disk machine had seed metering problems, and the hoe drill had depth control problems. Final assessment awaits germination and establishment measurements in 1986.

Horticultural Crops

"Vegetable Variety Trial"
C.O. Green
Prairie Produce Limited $4,700
Outlook

Abstract

Single row evaluations of carrot, pumpkin, eggplant, watermelon, cataloupe and broccoli varieties along with replicated trials of winter cabbage, cauliflower and pepper varieties were undertaken. A field scale evaluation of two red cabbage varieties and an on going field scale evaluation of strawberry varieties were also conducted.

Carrot: Hicolor 9 as in 1984 was the better variety followed by Canuck.

Pumpkin: Connecticut Field followed by Jack-o-Lantern and Spirit were the best varieties on the basis of one year's results.

Watermelon: Sugar Baby was the earliest maturing variety while Canada Super Sweet produced the largest mature fruit and the highest yield.

Cantaloupe: In this trial only Delicious 51, Canada Gem, Alaska, Honeyrock, Classic and Honeydew produced marketable fruit prior to frost with Delicious 51, Canada Gem and Alaska producing the better yields. Honeydew was the better yielder in its class.

Broccoli: Green Duke, Gem and Bravo continued to be the better varieties producing large good quality heads.

Winter Cabbage: Winter Keeper as in previous tests was the better yielder but not significantly different, Pick Green was second. Both produced a larger percentage of marketable heads.

Cauliflower: Snowcrown continued to be the earliest variety and the highest yielder with the highest percentage of marketable heads but lacked full self blanching characteristics. White Sails was second best followed by Snowball g.

Pepper: Since plants were unprotected except for some shelterbelt trees, yields were only 1/5 to 1/4 of those of a previous test when plants were protected by hotents. Super Set, Ace, Marengo and Argo were the earliest varieties followed by Ma Bell, Big Bertha, and Bell Bog. Shamrock followed by Marengo then Pip, Super Set, Big Bertha and Stokes Early Hybrid were the better yielders. Big Bertha followed by Pip and Skipper produced the largest most attractive fruit. Jalapeno is a small hot pepper with a lower yield but a large number of fruit.

Red Cabbage: After a number of replicated trials and a field test, Red Acre has proven to be the better variety with early large compact heads and a very high percentage of marketable heads in relation to planting. Since it does tend to produce larger heads unacceptable to wholesalers with excess plant spacing, spacing must be kept close. Mammoth Red Rock produces a very large plant but the head tends to be later, less compact, smaller and more variable in size than Red Acre so consequently is not recommended for commercial production.

Strawberries: Protem is not recommended for pick-your-own since the second flush of berries tend to be smaller and have gained less consumer acceptance. Trials are continuing with Bounty and Red Coat.

Ruminants

"Intensification of Sheep Production Under Prairie Conditions"
N.C. Rawlings, W.E. Howell
Departments of Veterinary Physiological Sciences and Animal and Poultry Science
University of Saskatchewan $30,000
Saskatoon

A flock of 288 Rambouillet, Suffolk, Columbia, Finn x Rambouillet, Finn x Suffolk and Finn x Columbia ewes were maintained over a 3 year period. One group of ewes (control) were bred once per year (October). The other groups of ewes (intensively managed) were bred every 8 months, but the breedings were staggered so that the two flocks lambed 4 months out of phase with each other. Estrus was synchronised in intensively managed ewes using intravaginal sponges

impregnated with medroxyprogesterone acetate. Breedings occurred in January, May and September. Artificial lighting was used to induce estrus for out of season breeding. The percentage of ewes lambing of those put to the ram averaged 88% for breedings in January, September or October and 64% for May breedings. Lambing percentage (number of lambs per 100 ewes lambing) was higher for crossbred (216%) than purebred ewes (165%), it was 172% followed breedings in May and averaged 192% for breedings in January, September or October. Intensive management resulted in an extra 37% lambs weaned and spread lamb supply across the year. The crossbred ewes weaned an average of 226 ± 10 lambs per 100 ewes under intensive management, with a high of 283 ± 26 for the Finn x Columbia ewes.

"Evaluation of Protein Status of Lactating Dairy Cows"
D.A. Christensen
Department of Animal & Poultry Science
University of Saskatchewan $17,000
Saskatoon

Protein is an expensive component in dairy cattle rations. It is essential to meet protein requirements of dairy cows, especially in early lactation in order to maximize milk production and optimize economic returns. Protein analysis of feedstuffs in feed testing laboratories is a useful source of information for formulating dairy cow rations. There is a need however, for a test to measure the protein status of dairy cows and that the form of protein (solubility and bypass value) is adequate to ensure that protein requirements are met. Plasma urea nitrogen levels have been used to assess the adequacy of protein intake in relation to requirements. This measurement. however, can only be used effectively under research conditions. The research project supported by this grant was aimed at evaluating milk urea nitrogen as a means of assessing adequacy of protein intake. Low and high crude protein rations were fed to lactating dairy cows. The results indicated that milk urea nitrogen may be an efficient method of estimating available protein in dairy cow rations and hence may be more effective than crude protein analysis of feeds in evaluating dairy rations. If further research proves this method to be satisfactory, it could be implemented on a province-wide basis to identify herds which are inappropriately fed.

To Evaluate Practical Post-Partum Nutritional and Dairy Managment in Controlled Breeding of Beef Cows
D. McCartney
Agriculture Canada $4,000
Melfort

Cow-calf operators often have an extended breeding season resulting in a longer than necessary calving season. At weaning time, calves then have wide weight range resulting in lower selling prices. Research in the United States has indicated that weaning calves for 48 hours at the start of the breeding season will influence when a cow shows estrus. A study was set up at the Melfort Research Station in co-operation with Dr. Bill Cates and Dr. Reuben Mapletoff of the Western College of Veterinary Medicine to evaluate the effect of weaning and post-partum nutrition in controlling the breeding of beef cows.

Bulls were turned into cows May 23 which was 20 days earlier than past years. Calves were weaned from the cows for 48 hours on June 5 and 6 in order to induce estrus naturally. At the end of that time the calves were returned to the cows. Cows were pregnancy checked several time in July and August resulting in 29% of the cows being bred in the first few days of breeding season and 48% of the cows being bred during or after the weaning period.

The resulting calving season in 1986 ended about 3 weeks earlier than in previous years. Further evaluation of the effects of weaning and the use of Estrumate and Synocromate are presently being evaluated.

Non-Ruminants

"Improved Swine Barn Ventilation Systems"
E.M. Barber
Department of Agricultural Engineering
University of Saskatchewan $36,000
Saskatoon

The objective of this three-year project is to evaluate and develop complete swine barn ventilation systems that will work under Saskatchewan's severe climatic conditions. At the end of the second year of the project, environmental data have been collected for comparison of four different fan and fan control systems installed in farrowing rooms. Data from a wide range of outdoor temperature conditions currently are being evaluated. A logic-based fan-heater sequencer is being compared to more concential thermostats. Modifications have been made to previously unworkable air inlets: Plans now are available for constructing simple air inlet systems that have been demonstrated to work at the Prairie Swine Centre. A new system for automatic adjustments of slot air inlets has been built and is being evaluated. A new system for reliably achieving winter ventilation rates in small rooms also is being evaluated. The characteristics of variable speed fans and fan controllers have been measured so as to clarify some of the limitations of these systems. Preliminary investigations have been conducted into the effect of backdraft shutters on fan performance. Complete equipment records have been established for all ventilation equipment at the Praire Swine Centre. In the longer term, it now will be possible to respond to producer questions about maintenance requirements and operational limitations and benefits of the particular types of equipment installed at the Swine Centre. The results of this project will be very important to any livestock producer wishing to renovate or build new confinement facilities.

"Dietary Enzyme Supplementation as a Method of Improving the Nutritional Value of Cereal Grains"
H.L. Classen, G.L. Campbell and R.E. Salmon
#6-84-27

The objectives of this project are to study the practical use of dietary enzymes for improving the nutritional value of Saskatchewan grown cereal grains. Cereal grains such as barley and oats are not considered

good feed ingredients for poultry. With both barley and oats, the relatively high level of crude fibre is not digested by the chicken. But more important are carbohydrate constituents which are very viscous in water and cause a reduction in the digestion and absorption of nutrients by the bird. Research in our lab has demonstrated that dietary enzymes can break down the deleterious carbohydrate and make barley and oats more nutritious for poultry. This study is designed to examine the use of dietary enzymes in diets for broiler chickens, laying hens and turkeys.

The major benefit of our results is the use of cheaper, locally grown feed grains in poultry rations. This would improve the competitive advantage of Saskathcewan poultry producers by taking advantage of nearness to a major feed grain production area. Informtion on the utilization of barley and enzymes in poultry diets may also improve the export value of barley because sales for poultry feed represent an important component of the feed grain market.

"A Feeding Regime for Early Weaned Piglets Based on the Natural Behaviour of the Piglet"
N.J. Lewis
Department of Animal & Poultry Science
University of Saskatchewan $23,000
Saskatoon

Early weaned piglets are artificially weaned at a time when milk is still a large part of their intake and are placed on a diet composed completely of solid feed. These piglets, inexperienced with controlling feed intake, may be over consuming or under consuming feed, causing digestive problems, scouring and diminished growth rate. The use of a controlled feeding system for the first week following weaning could solve these problems by teaching them how to control their feed intake properly. A previous study used an operant conditioning apparatus to determine the optimum number, size and distribution of meals based on the hunger and satiety of the piglet. The objective of this study will be to test this feeding regime under commercial conditions to determine if this feeding system will increase the feed consumption of early weaned piglets while reducing scours due to digestive problems.

Following the results of this test it should be possible to advise producers who are having problems with a lag in growth rate following weaning on whether or not a meal feeding program will reduce this problem substantially.

The Feasibility of Utilizing Saskatchewan Reared Honeybee Queens in Commercial Honey Production
T. Taylor and S. Clifford
Nipawin

The main objective of this project is to establish a greater degree of self-sufficiency in the commercial honeybee industry of Saskatchewan. Traditionally, beekeepers in Saskatchewan who winter their colonies replace their annual winter loss with bees and queens purchased in the United States. However, the northward migration of the Africalized honeybee mellifera aclonsonni, is posing a double threat to these supplies. The honeybee itself is expected to have a profound effect in the bee-rearing belt of the southern states. The second threat is caused by the varroa mite being carried by these bees. This mite which had been unknown in North America, is generally regarded as the worst honeybee pest in existence.

This project is evaluating various techniques of Queen/brood transfers to determine the most efficient method in terms of success and how it fits into the schedule of commercial honey production. The timing of the transfers is varied to determine if it can be more effectively managed within existing time constraints.

Events in the United States are going to require that Saskatchewan honey producers become more self-sufficient. The results of this work should assist in this goal. As well, through improved queen management it should be possible to improve the honey production of over-wintered colonies.

Land, Air and Water

"The Determination of Trifluralin Levels in Soil by Instrumental Analysis and Bioassay"
R.B. McKercher
Department of Soil Science
University of Saskatchewan $20,000
Saskatoon

The analyses of soils to determine herbicide residue levels is normally carried out by first extracting the herbicide from the soil and subsequently analyzing the extract for its content of the herbicide. The analysis is mostly by means of an expensive instrument, often a gas-liquid chromatograph. An alternative method is the bioassay wherein the oil has a plant or a seedling that is relatively sensitive to the herbicide grown in it at several dose rates.

Either method has its own difficulties. On the one hand instrumental analysis is considered to measure most of the soil content of the chemical but cannot indicate how much of the material may be active against plants. On the other hand, the bioassay will indicate very well the actual activity levels in soil for the particular test plant and the conditions of temperature and moisture in the soil. These may not however, represent field activities or the potential for field activities.

Any studies so far to relate the one type of test to another have been of questionable success and indeed very few in number. This project has as its goal to provide information on this matter. Two field tests are in progress one east of Saskatoon and the other near Craik. Each has similar treatments and the main chemical is trifluralin, a major use chemical for millet control. Field, laboratory and growth chamber studies are being conducted along with a rigid moisture monitoring at the field sites. Further data being collected are the weed controls achieved by herbicide use as compared to cultural practices. The project was begun in the fall of 1985 and will continue during both the 1986 and 1987 field seasons.

"Mineralogy, Morphology and Dynamics of Salts in Agricultural Soils of Saskatchewan"
A.R. Mermut
Department of Soil Science
University of Saskatchewan $20,000
Saskatoon

Salinity is recognized as an important problem for agriculture in Saskatchewan. The objective of this project was to investigate the origin and formation of salts and their significance in relation to salt loading groundwater and/or aquifers and to provide basic information for the reclamation of saline soils in the province. Because of its complex nature little is known about the basic mineralogical aspect of salts in Saskatchewan soils. Recent studies elsewhere clearly clearly demonstrated that studies related to chemistry and mineralogy are of great importance in understanding the formation, source and fate of salinity. Suitable techniques for land reclamation can only be developed if the nature and origin of salinity is thoroughly understood. Our studies on soil water and salt crust samples indicated that some minerals found in soil environment are unfortunately still actively contributing increasing salinization in the surface soils in many areas of Saskatchewan which makes the problem more difficult. Most of the salts tends to accumulate on the surface due to climatic and soil conditions as well as the chemical and mineralogical nature of salts. Management techniques should be developed to reduce the upward movement of salts and stabilize the lower part of the profile and thus reduce the level of salts by encouraging the formation of less soluble salt species. Further studies on the nature of salts are needed for better understanding and use and management of salt affected soils in Saskatchewan.

Energy, Equipment

"Comparative Efficiency of New Low Volume Applicators with Herbicides"
R. Ashford
Department of Crop Science and Plant Ecology
University of Saskatchewan $15,000
Saskatoon

The objective of this study is to demonstrate, under field conditions, how improved controlled drop applicators, such as are currently available on a commercial basis, compare with standard hydraulic nozzles for herbicide applicaton. Major advantages in favour of these new applicators are attributable to the fact that they provide relatively uniform drop sizes, and operate at very low spray volumes per hectare.

In extensive field trials at Saskatoon in 1985 it was found that the herbicidal effect of a contact herbicide such as bromoxynil was 20 to 30% less when applied with rotary atomizers in spray volumes of 22 to 44 L/ha, than when applied in 22 L/ha with flat-fan nozzles.

Translocated herbicides such as 2,4-D and glyphosate (Roundup), however, were at least as effective when applied by rotary atomizers as they were when applied in relatively high spray volumes with hydraulic nozzles. In fact, marginal to sub-marginal rates of glyphosate, 0.11 to 0.18 kg/ha, gave quite satisfactory controls of annual plant species when applied in spray volumes of 22 L/ha by rotary atomizers.

Similar rates of glyphosate applied in 110 L/ha of spray by hydraulic nozzles gave very poor control.

The major point that requires emphasis based on results obtained in 1985 is that controlled drop applicators such as the rotary atomizer are better suited to application of some herbicides than others.

Socio-Economics

"The Comparative Advantage of Wheat Production in Saskatchewan"
W.H. Furtan
Department of Agricultural Economics
University of Saskatchewan $15,000
Saskatoon

This study investigates the relative increase in yields of new cultivars within the different classes of wheat and compares the size of the increases with the gains achieved in alternative crops grown in the Prairie region. The second part of the study will then look at similar gains that have occurred in the U.S. and will determine where the gains have been the greatest. Data is from research stations in the three Prairie provinces although the major conclusions are derived for Saskatchewan.

Comparative advantage lies with the region that can produce a commodity relatively more cheaply than its competitor. Given that there are no tariffs on inputs and machinery, production costs should be similar in both Canada and the U.S. we need to know which technology will give us the comparative advantage. This should then allow the producer to maximize wealth and income.

Saskatchewan Agricultural Research Fund

Financial Statements

For the year ended March 31, 1986
Office of the Provincial Auditor
Regina, Saskatchewan

Auditor's Report

To the Members of the Legislative Assembly
Province of Saskatchewan

I have examined the balance sheet of the Saskatchewan Agricultural Research Fund as at March 31, 1986, and the statement of revenue, expenditure and fund balance for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Fund as at March 31, 1986, and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Regina, Saskatchewan,
May 12, 1986

W.G. Lutz, F.C.A.,
Provincial Auditor.

Statement I

Saskatchewan Agricultural Research Fund
Balance Sheet
March 31, 1986
(with comparative figures at March 31, 1985)

	1986	1985
Assets		
Cash in bank	$ 9,492	$ 7,601
Investments - at cost (Schedule 1)	3,570,485	3,682,843
Accrued interest receivable	126,297	98,828
	$ 3,706,274	$ 3,789,272
Liabilities and Fund Balance		
Liabilities:		
Grants committed	$ 442,853	$ 534,182
Accounts payable	--	1,658
	442,853	535,840
Surplus:		
Capital funds (Note 4)	3,263,421	3,253,432
	$3,706,274	$3,789,272

(See accompanying notes to the financial statements)

Statement 2

Saskatchewan Agricultural Research Fund
Statement of Revenue, Expenditure and Fund Balance
For the Year Ended March 31, 1986

	1986	1985
Revenue:		
Investment interest	$ 376,609	$ 433,751
Expenditure:		
Grants committed during the year (Note 5)	363,763	430,658
Board expenses	2,857	4,219
Printing costs	--	1,658
Total expenditure	366,620	436,535
Excess of revenue over expenditure (expenditure over revenue)	9,989	(2,784)
Fund balance, beginning of year	3,253,432	3,256,216
Fund balance, end of year	$ 3,263,421	$3,253,432

(See accompanying notes to the financial statements.)

Saskatchewan Agricultural Research Fund
Notes to Financial Statements
March 31, 1986

1. Accounting Policies

These financial statements are prepared in accordance with generally accepted accounted principles.

a) Grant Commitment

Grant commitments are recorded as an expenditure of the Fund at the point in time the Saskatchewan Agricultural Research Fund Board approves the grant. Grants committed but not paid at the year end are reflected as a liability on the balance sheet.

2. Related Party Transactions

a) Costs Borne by Other Agencies

In accordance with established government practice, the Saskatchewan Agricultural Research Fund has not been charged with any occupancy costs and no provision for such costs is reflected in these financial statements. These costs together with certain general administrative and employee benefit costs are absorbed by various departmental appropriations.

3. Incorporation

The Saskatchewan Agricultural Research Fund was incorporated under the Agricultural Research Funding Act, Chapter A-14.1, 1978 Revised Statutes of Saskatchewan. This Act came into force by proclamation of the Lieutenant Governor on June 15, 1979. The Saskatchewan Agricultural Research Fund is a capital fund from which grants are made to individuals, corporations, co-operatives, partnerships, associations or other organizations for the purpose of agricultural research in the province.

4. Capital Funds

This Fund was initially financed by an appropriation of $3.25 million in the year ended March 31, 1980. The intention of the Saskatchewan Agricultural Research Fund Board from the date of inception until February 2, 1984, was that only the investment income on the $3.25 million would be made available for expenditures. Effective February 2, 1984, the Saskatchewan Agriucltural Research Board passed a motion "that a maximum of $20,000 from the capital fund be used for grants for the 1984-85 fiscal year." Therefore, at the comparative fiscal year-ends the capital funds would consist of:

	1986	1985
Funds available for grants	$ 33,421	$ 23,432
Capital funds, not available for grants	3,230,000	3,230,000
	$3,263,421	$3,253,432

5. Grants Committed

Grants committed during the year have been reduced by $14,487 (1985 - $14,742) representing prior year projects that have been terminated.

Schedule 1

Saskatchewan Agricultural Research Fund
Summary of Investments
As at March 31, 1986

Description	Rate	Maturity Date	Amount
First National Bank of Chicago Certificate of Deposit	11.625	April 1, 1986	$1.000.000
Province of Ontario Treasury Bill	9.85	April 2, 1986	34.215
Government of Canada. Treasury Bill	8.85	April 4, 1986	513.925
Barclays Bank Bankers Acceptance Papers	10.30	April 17, 1986	53.638
Canadian Imperial Bank of Commerce Bankers Acceptance Papers	8.78	April 21, 1986	52.815
Government of Canada Treasury Bill	8.76	May 2, 1986	57.489
Bank of Nova Scotia Bankers Acceptance Papers	12.59	May 12, 1986	4.858
Canadian Imperial Bank of Commerce Bankers Acceptance Papers	9.00	May 20, 1986	23.920
Canadian Pacific Securities Ltd. Promissory Note	10.70	June 18, 1986	92.850
Imasco Promissory Note	10.50	June 19, 1986	58.535
Fuji-Bearer Discount Note	10.35	July 3, 1986	101.936
Government of Canada Treasury Bill	9.25	July 11, 1986	75.903
Government of Canada Treasury Bill	10.21	July 25, 1986	499.567
Canadian Imperial Bank of Commerce Mortgage Corporation Certificate	11.50	April 18, 1989	500.000
Royal Trust Bond	11.10	August 21, 1990	500.834
Total Investments			$3.570.485